AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions and listings of claims in the application:

LISTING OF CLAIMS:

1. (original): An object activity modeling method comprising the steps of:

(a) obtaining an optical flow vector from a video sequence;

(b) obtaining the probability distribution of the feature vector for a plurality of video frames, using the optical flow vector;

a1

(c) modeling states, using the probability distribution of the feature vector; and

(d) expressing the activity of the object in the video sequence based on state transition.

2. (original): The object activity modeling method of claim 1, wherein the step (a) is based on affine motion estimation.

3. (original): The object activity modeling method of claim 2, wherein the step (a) further comprises the sub-steps of:

(a-1) grouping input video frames into a plurality of video frame groups and dividing each video frame group as an individual state;

(a-2) obtaining an affine motion parameter for each video in the video frame group of each individual state; and

(a-3) obtaining an optical flow vector from the affine motion parameters.

4. (original): The object activity modeling method of claim 3, wherein the step (a-2) comprises a step for determining parameters, which minimizes summed square difference $\sum(I_t(x) - I_{t-1}(x - V(x)))^2$ over a given video based on the intensity of the pixel on the object, which is expressed as $I_t(x)=I_{t-1}(x-V(x))$ when I denotes intensity, t denotes time, x denotes a pixel location (x, y), and v denotes the motion vector, as motion parameters.

A1

5. (original): The object activity modeling method of claim 1, wherein the step (b) comprises a step for calculating probability distribution $P(Z|\Omega)$ by the following equation:

$$P(Z|\Omega) = \frac{\exp(-\frac{1}{2}(z-m)^T)Q^{-1}(Z-m))}{(2\pi)^N|Q|^{1/2}}$$

wherein $P=(p_1,p_2, \ldots p_d)$ denotes a motion vector calculated at each pixel location (x, y), L denotes the number of pixels in a video frame or a region of interest, d denotes the number of dimensions, feature vector Z, which is a d x L dimension vector, is $Z = (p_1^1, p_1^2, \ldots, p_1^L, p_2^1, p_2^2, \ldots, p_2^L, p_d^1, p_d^2, \ldots p_d^L)^T$, m is the mean vector of feature vector Z, and Q is the covariance matrix of feature vector Z, and it is assumed that feature vector Z is provided from observation class Ω.

6. (original): The object activity modeling method of claim 1, wherein the step (b) further comprises the steps of:

decomposing covariance matrix Q as the following equation:

$$Q = \Phi\, \Lambda \Phi^T$$

Wherein $\hat{Z}$ is equal to Z-m, the columns of Φ are orthonormal eigenvectors of covariance matrix Q, and A corresponds to the diagonal eigenvalue; and

calculating probability distribution $P(Z|\Omega)$ by the following equation:

a'

$$P(Z|\Omega) = \left[\frac{\exp(-\frac{1}{2}\sum_{i}^{M} y_i^2 / \alpha_i}{(2\pi)^M |\Lambda|^{1/2}}\right]\left[\frac{\exp(-\frac{1}{2}\sum_{M+1}^{N} y_i^2 / 2\rho)_i}{(2\pi\rho)^{(N-M)/2}}\right]$$

wherein M is the number of principal components, y_i is the i-th component of Y, α_i is the i-th eigenvalue of Q, and ρ is the optimal value, which is obtained by $\rho = \frac{1}{N-M}\sum_{M+1}^{N}\alpha_i$, and it is assumed that feature vector Z is provided from observation class Ω.

7. (original): The object activity modeling method of claim 1, wherein in the step (c), the object activity in the video sequence is expressed using a Hidden Markov Model (HMM), based on state transition.

8. (original): The object activity modeling method of claim 7, wherein the Hidden Markov Model (HMM) is expressed as $\lambda=\{\Xi, A, B, \Pi\}$ when N is the number of possible states, Ξ satisfies $\Xi = \{q_1, q_2, ..., q_N\}$, A is $\{a_{ij}\}$, the transition between hidden states i and j, B is $\{b_j(.)\}$,

the observation symbol probability corresponding to state j, and Π is the initial state distribution, and the state $\Xi = \{q_1, q_2, ..., q_N\}$ and the initial state distribution Π are determined in advance based on video data.

9. (original): An object activity recognition method comprising the steps of:

(a) obtaining feature vectors by motion estimation for video frames;

(b) determining a state, to which each frame belongs, using the obtained feature vectors; and

(c) determining an activity model, which maximizes the probability between activity models and a video frame provided from a given activity model dictionary using a transition matrix for the determined state, as the recognized activity.

10. (currently amended): The object activity recognition method of claim 9, wherein the step ~~(d)~~ (c) comprises a step of finding an activity model, which maximizes probability $P(O|\lambda)$ from the given activity model dictionary $\{\lambda_1, \lambda_2, ..., \lambda_E\}$, when T is a positive integer indicating the number of frames forming the video sequence, $Z_1, Z_2, ..., Z_T$ are feature vectors of first frame, second frame, ..., T-th frame, respectively, and if video frame $O=\{Z_1, Z_2, ..., Z_T\}$ is given and E is the number of state models.

11. (original): The object activity recognition method of claim 10, wherein the transition matrix is obtained by using an expectation-maximization (EM) algorithm based on the observation symbol probability $\{b_j(.)\}$ corresponding to scene j in the training process.